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(54) Title: INVENTORY CONTROL PROCESS FOR RESERVATIONS SYSTEMS

(57) Abstract

A reservations system for hotel chains in which matrix arrays defining maximum rooms for sale, protected inventory, and matrices derived from these two, all by room-type/rate-category combinations. The system provides for generalized control of inventory for sale for an arbitrary number of room-types, rate categories, etc. The system also allows blocking or protecting inventory by rate-category, room-type, or any combination. The system of the invention allows for either a central or a distributed view of inventory, and allows inventory to be controlled by the property and sold at any location without overselling. The system of the invention provides the level of control necessary to handle the four major inventory control strategies that the hotel industry will likely require over the next ten years: total control centrally, central indicators and distributed inventory, totally distributed inventory, or a mixed mode of operation utilizing any combination of central or distributed inventory.

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INVENTORY CONTROL PROCESS FOR RESERVATIONS SYSTEMS

BACKGROUND OF THE INVENTION

Existing inventory systems for hotels today offer a limited capability for managing inventory effectively. Most of these systems are either based on a derivative of an airline seat reservation system, or are scaled-up versions of single property reservations systems. The systems currently used by major hotel chains are basically limited-control, declining inventory systems. They have defined numbers of buckets or inventory counters available for each day of inventory. The systems are limited to less than one year of inventory for a number of technical reasons. Many companies have extended their existing systems to allow for more room-types, and to include additional software to provide some inventory control and inventory blocking. However, these systems cannot provide general inventory availability, but require inventory to be assigned to sub-categories where it remains until reassigned for general inventory use. In addition, the price and rate calculation in these systems is combined with the inventory records, so that physical room-type and rate for the room are directly linked.

Existing systems that derive from single property reservations systems have similar limitations, in that they tend to focus on physical room-types and assign rates to those physical room-types. Inventory is kept by room-type, and limits on number of rates available for sale are usually

not provided, except in special cases. When provided, they require additional code customized to the rate-category or the offering, and do not employ a general approach.

Airline systems today have sophisticated yield-management and rate capacity control algorithms. Based on observation of airline rate control practices, the availability of rates is managed by an off-line yield-management system, and rate availability is changed either manually or semi-automatically based on output from the yield-management system. In practical terms, a very large yield-management and rate capacity control operation is required to effectively manage and control availability of rates.

Therefore, current practice for hotel reservations systems can be described as accounting and control of physical room-types, with limited control of rates available for sale for each room-type. There are no existing reservations or inventory control systems in use in hotels or in the travel industry that provide the degree of control by room-type, rate-category or both that the present invention offers.

Other perishable inventory systems where the present invention is applicable would include rental cars, cruise-lines, event-ticketing, and any other application where the combination of a physical item for sale is often secondary to the rate at which that item is sold and the control of the availability of that rate for sale. For instance, in event-ticketing, the price on certain

tickets could be changed as the event approaches or as certain other thresholds are met.

SUMMARY OF THE INVENTION

The system of the present invention is ideally suited to an automated link with the yield-management system that recommends and specifies the exact numbers of rates to be made available for sale. Since most yield-management systems tend to focus on opening and closing available rates, reflecting the limitation of existing reservations systems, the present invention provides the best possible target for a sophisticated yield-management system. The information provided by the invention, namely the specific room-type and rate-category counts sold to date, could be passed at any time to a yield-management system, providing far better information about inventory status and maximization of profit.

The system of the invention also allows for either a central or a distributed view of inventory. Current systems tend to use open/closed indicators at the central site, or allocations of inventory from the property. This system allows inventory to be controlled by the property and sold at any location without over-selling. As an example, some hotel chains keep inventory with free sale indicators that are updated manually by the property. When inventory and/or room-types are no longer available for sale, they need to be changed manually by the property. Some chains control all inventory and process all inventory transactions

centrally. This approach provides a higher level of control, but incurs very large central operating costs, as well as very high communications costs.

In summary, the system of the invention provides the level of control necessary to handle the four major inventory control strategies that the hotel industry will likely require over the next ten years: total control centrally, central indicators and distributed inventory, totally distributed inventory, or a mixed mode of operation utilizing any combination of central or distributed inventory. In each case, the system of the invention provides a common, effective and complete solution.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be more readily understood with reference to the accompanying drawing, wherein:

Figure 1 is a flow chart showing the initializing of inventory performed according to the system of the invention; and

Figure 2 is a flow chart showing the logical steps performed by the system of the invention during the daily selling and updating of inventory of the hotel chain, or the like.

DETAILED DESCRIPTION OF THE INVENTION

In the following, references to the drawings, where applicable, will be indicated in parentheses next to the particular logical step described. The algorithms used to implement the reservation system of the invention utilize a set of

matrix data arrays and a set of rules based on the matrix arrays. Each matrix array is composed of i rows representing rate-categories and j columns representing room-types. A different array exists for each inventory-date, and may be differently dimensioned, i.e., each date may have a different number of rate-categories defined, and each season may have different room-types. Six logical arrays are defined as follows:

AA	is the maximum number of rooms authorized for sale
A	is the number of rooms currently available for sale
S	is the number of rooms sold
B	is the number of rooms blocked or protected
RB	is the number of rooms remaining in a block (still protected)
F	is a table of availability flags showing "Open," "Request," or "Closed"

AA and B are set by the reservations-manager (Fig. 1, Block 20). S is updated as rooms are sold or cancelled. A is calculated from number of rooms authorized and number sold. In addition to setting the maximums available for sale in AA, the reservations-manager can protect inventory by specifying a minimum available for a room-type/rate-category combination. The array B contains these minimums. The array RB is calculated from arrays B and S, and indicates the number of rooms remaining to be sold to satisfy blocks. The array F is set automatically based on arrays A and RB.

An arbitrary number of rows may be defined

in the arrays for each inventory-date, based on the number of rate-categories available. A rate-category may be a special rate available for a specific group or type of guest (qualified rate) or may be one of many rates generally available (unqualified rate).

Most hotels would have the same room-types year-round, and hence would have the same number of columns. In some cases, a hotel might have seasonal or other reasons to change the number of room-types defined. Recognition of a consistent number of room-types and a variable numer of rate-categories is a key element of the system of the invention. This observation is also the key to utilizing relational database methods to manage inventory.

The second key element of the system of the invention is that it allows the reservations-manager to place maximums (limits) and minimums (blocks) on total rooms, rate-categories, room-types, and/or specific combinations of rate and room-type. The user may limit the total number of rooms available for all room-types in a rate-category to be less than the sum of rooms specified as available for all room-types in that rate-category. The user may also limit the number of rooms available for a room-type to be less than the sum of the rooms available for that room-type in all rate-categories. This flexibility allows a reservations-manager to specify maximums available for each rate/room-type combination, and maximums for each rate and room-type, and allow the system to prevent overselling.

The system also allows the reservation-

manager to block inventory for specific rat - categories (such as groups or special packages) and specify which room-types may be sold to satisfy the block. Finally, the invention allows the user to set an overall limit on the number of rooms available for each day, which may override the total number of rooms available for all room-types in all rate-categories.

The reservations-manager can specify four levels of limitations or maximums:

AA_{ij}	is the maximum that can be sold for a specific rate
AA_{i0}	is the maximum that can be sold for rate category i
AA_{0j}	is the maximum that can be sold for a room-type j
AA_{00}	is the maximum that can be sold for that day

The availability matrix array A is calculated from the matrix arrays AA and S, and represents the number of rooms left to sell. According to the invention, the sum of all room-types available for sale in a given rate-category (matrix row-sum) may exceed the maximum allowed for the rate-category. The practical explanation is that many room-types may be sold in the same rate-categories to satisfy customer preference. The advantage of the invention is that the reservations-manager does not need to make a specific, rigid allocation of rooms by physical room-type to a rate-category.

In practice, a warning message would be issued if the reservation manager has not specified

enough rooms available for a room-type, a rate-category, or for the day, as follows, it being understood that the term SUM in the following refers to the iterative process associated with matrix analysis:

If $\underset{i=1}{\overset{M}{SUM}}\ AA_{ij} < AA_{0j}$	not enough inventory allocated to rate categories 1 to M for room-type j
If $\underset{j=1}{\overset{N}{SUM}}\ AA_{ij} < AA_{i0}$	not enough inventory allocated to room types 1 to N for rate-category i
If $\underset{i=1}{\overset{M}{SUM}}\ AA_{i0} < AA_{00}$	not enough inventory allocated to all rate-categories for this day
If $\underset{j=1}{\overset{N}{SUM}}\ AA_{0j} < AA_{00}$	not enough inventory allocated to all room-types for this day

In general, the reservations-manager would maintain a balanced or slightly oversold condition, so that the following relations would hold:

for all j	$\underset{i=1}{\overset{M}{SUM}}\ AA_{ij} \geq AA_{0j}$ (Fig.1,Block 29)
for all i	$\underset{j=1}{\overset{N}{SUM}}\ AA_{ij} \geq AA_{i0}$ (Fig.1,Block 28)

If these above-logical relations do not hold, then an error messages will b generated (Fig. 1, Blocks 30, 32).

The system also guards against blocking more inventory than is available. For instance, if a reservations-manager tried to block more inventory in individual rate-categories than was available for a room-type, an error message would be generated (Fig. 1, Block 28). The system forces the following relations to hold:

For all i and j $A_{ij} \geq B_{ij}$ (Fig.1,Block 21)

For all j $A_{0j} \geq B_{0j} \leq \sum_{i=1}^{M} B_{ij}$
(Fig. 1, Blocks 22,23)

For all i $A_{i0} \geq B_{i0} \leq \sum_{j=1}^{N} B_{ij}$
(Fig. 1, Blocks 24,25)

$\sum_{j=1}^{N} B_{0j} \leq A_{00} \geq \sum_{i=1}^{M} B_{i0}$
(Fig. 1, Block 26)

Referring to Fig. 2, in order to satisfy a request for "r" rooms for a span of dates, for room-type i and rate-category j, the following availability-relations must be true for each day (Fig. 2, Block 40, 42):

$A_{ij} \geq r$	inventory available for this rate/room-type
$A_{i0} \geq r$	inventory available for this rate-category

$A_{0j} \geq r$ inventory available for this room-type

$A_{00} \geq r$ total inventory available

Once the general availability of the required number of rooms has been established, additional rules must be applied to ensure that this sale will not violate a block. A block is not considered satisfied until the number of rooms sold is greater than or equal to the number blocked. The elements of the table RB indicate which blocks are still outstanding by calculating remaining blocked inventory as follows:

$$RB_{ij} = MAX\ (0,\ B_{ij} - S_{ij})$$

$$RB_{i0} = MIN\ (B_{i0},\ \sum_{j=1}^{N} RB_{ij})$$

$$RB_{0j} = MIN\ (B_{0j},\ \sum_{i=1}^{M} RB_{ij})$$

$$RB_{00} = MIN\ (B_{00},\ \sum_{i=1}^{M} RB_{i0},\ \sum_{j=1}^{N} RB_{0j})$$

In practice, "overblocking" would not be allowed, so that last relation would be:

$$RB_{00} = \sum_{i=1}^{M} RB_{i0} = \sum_{j=1}^{N} RB_{0j}$$

In order to handle blocking in all cases, including overcommitting by rate-category (block B_{i0} rooms for rate-category, and also set B_{ij} to the

same number for all room-types checked) the following rules must be applied:

If enough inventory is available for the day, then sell any rate-category; else only free to sell blocked rates.

If $A_{00} - RB_{00} \geq r$ then free to sell any rate (Fig. 2, Block 44).

If enough inventory is available for the rate-category or room-type, then free to sell any room-type or rate-category respectively. Otherwise, only sell room-types or rates that have "remaining blocked" inventory (Fig. 2, Block 46).

If $A_{i0} - RB_{i0} \geq r$ (Fig. 2, Block 48), then free to sell any room-type for rate-category i; otherwise, can only sell blocked room-types in this rate-category (Fig. 2, Block 50).

Similarly, for room-type j.

If $A_{oj} - RB_{0j} \geq r$ (Fig. 2, Block 52), then free to sell any rate-category in room-type j; otherwise only sell rates with "remaining blocked" inventory (Fig. 2, Block 54).

A request for "r" rooms for a span of days must satisfy all of the following rules for each day:

General Availability Rules (Fig. 2, Block 42)

1)	$A_{00} \geq r$	Inventory available for total hotel for this day
2)	$A_{i0} \geq r$	Inventory available for rate-category $_i$ for this day
3)	$A_{0j} \geq r$	Inventory available for room-type $_j$ for this day

4) $A_{ij} \geq r$ Inventory available for the specific combination of rate-category $_i$ and room-type $_j$ for this day

Protected Inventory Rules (Fig. 2, Blocks 44-54)

5) $A_{00} - RB_{00} \geq r$ Unblocked inventory available for the day

or $A_{00} - RB_{00} < r$ If not, then only blocked inventory can be sold, so blocked inventory must be available for the rate-category, room-type, and combination

and $RB_{i0} \geq k$ and $RB_{0j} \geq k$ and $RB_{ij} \geq k$

where $k = r - (A_{00} - RB_{00})$

6) $A_{i0} - RB_{i0} \geq r$ Unblocked inventory is available for this rate category

or $A_{i0} - RB_{i0} < r$ Only blocked inventory available for this rate category, so blocked inventory must be available for the rate/room-type combination

and $RB_{ij} \geq r - (A_{i0} - RB_{i0})$

7) $A_{0j} - RB_{0j} \geq r$ Unblocked inventory for this room-type

or $A_{0j} - RB_{0j} < r$ Only blocked inventory available for this room type, so blocked inventory and must be available for the combination

and $RB_{ij} \geq r - (A_{0j} - RB_{0j})$

Availability Flag Process

In most reservation systems, checking for

availability of rates and room-types occurs much more often than the inventory sale or cancel process. Therefore, a table can be created that represents the availability status of all rates and room-types which results in a simplified availability checking process. This table can also be used to simplify inventory- handling and availability-checking for distributed inventory and manual systems, while maintaining the advantages of the reservation process of the invention.

The array F contains flags or semaphores that represent the current availability-status determined from the arrays A and RB. Each entry in F indicates "open" or "closed" based on the result of applying availability-rules to A and RB. Certain restrictions are applied when using F to determine current availability. The "open" status indicates that inventory is available for sale, but that "free sale" would be limited to "K" rooms. The constant K represents the free sale limit, or the maximum number of rooms that can be sold against an "open" indicator for each transaction.

The additional status indicator "Request" is used to indicate that inventory may be available, but a complete check is required before a sale can be made. For centralized systems, a complete check means applying all availability rules. For distributed inventory systems, a request must be made to the distributed system.

The flag process provides two key advantages. First, it reduces the overhead associated with checking availability, since

availability is checked more often than changed. Second, it provides a consistent view of inventory in a distributed system by maintaining only one copy of the inventory data base. Also, the inventory data base may be kept centrally or may be distributed. In that way, availability can be checked anywhere, in any combination of systems while maintaining a consistent view of inventory to users at all locations.

Since the system of the invention is not affected by the location of the inventory data base, this system could be used for the four typical inventory distribution cases in any combination, as follows:

- Centralized - all inventory is kept centrally for all properties, and all transactions are processed centrally.
- Central control - inventory is kept centrally, but distributed locations such as properties can process transactions against availability flags.
- Distributed - inventory is kept at distributed locations (e.g. properties or regional reservations centers) and availability flags or inventory allocations are maintained at a central location.
- Mixed - combinations of all three above based on individual property or chain requirements.

The last mode of operation is the most promising for large hotel chains in the future, where imposing one of the other three modes of operation on all properties would be difficult,

time-consuming or expensive. For multi-chain operators, using the best mode of reservations-operation for each chain will reduce operating cost and the development cost associated with "compromise" system solutions.

The system utilizes any conventional mainframe computer system with sufficient memory capacity for the central portion of the system. Minicomputers, microcomputers and personal computers may be utilized for the distributed portion of the system of the invention. Any conventional on-line system may be used for a centralized mode of operation. Other modes could use public or dial networks to implement the system.

While a specific embodiment of the invention has been shown and described, it is to be understood that numerous changes and modifications may be made therein without departing from the scope, spirit and intent of the invention as set forth in the appended claims.

WHAT IS CLAIMED IS:

CLAIM 1. An inventory-control system for allocating items of inventory in an optimal manner, comprising:

inventory comprising a plurality of different groups of inventory items, each said group having at least one inventory item therein, each said inventory item in each said group being uniquely characterized from an inventory item in another said group, each said inventory item having a first characteristic and a second characteristic, with one of said first and second characteristics thereof being equal to a characteristic of at least one other inventory item of at least one other said group;

a computer, said computer having memory means for storing therein information representative of said group of inventory items and each said inventory item in a respective said group;

said memory means comprising:

a first portion for storing therein data by said first and second characteristics of each said inventory item, said data being representative of the total maximum inventory of inventory items available for potential use;

a second portion for storing data therein by said first and second characteristics of each said inventory item, said data being representative of protected inventory items in said groups; and

first generating means for generating computer signals of said representative data of said first portion as a first matrix array of n rows by m

columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the maximum potentially available said inventory items for the specific said group;

second generating means for generating computer signals of said representative data of said second portion as a second matrix array of n rows and m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the blocked available inventory for the specific said group.

CLAIM 2. The inventory-control system for allocating items of inventory in an optimal manner according to Claim 1, wherein said memory means further comprises:

a third portion for storing therein representative data, by said first and second characteristics of each said inventory item, of total inventory items currently available for use;

third generating means for generating computer signals of said representative data of said third portion as a third matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the number of inventory items currently

available for use for the specific said group;

a fourth portion for storing therein, by said first and second characteristics of each said inventory item, representative data of the number of inventory items already used;

fourth generating means for generating computer signals of said representative data of said fourth portion as a fourth matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the number of inventory items used of said inventory items for the specific said group;

a fifth portion for storing therein representative data, by said first and second characteristics of each said inventory item, of the blocked inventory items still available for potential use;

fifth generating means for generating computer signals of said representative data of said fifth portion as a fifth matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the number of blocked inventory items rooms still potentially available for the specific said group.

CLAIM 3. The inventory-control system for allocating items of inventory in an optimal manner

according to Claim 2, wherein said memory means further comprises:

a sixth portion for storing data of said inventory items representative of the desired total maximum items of inventory desired to be used for each said first characteristic, total maximum inventory items desired to be used by each said second characteristic, and total maximum inventory items desired to be used for all of said first and second characteristics combined; and

sixth generating means for generating computer signals of said representative data of said sixth portion.

CLAIM 4. The inventory-control system for allocating items of inventory in an optimal manner according to Claim 1, herein said inventory items comprise hotel rooms; each said first characteristic being a rate-category for hotel room, and each said second characteristic being a type of hotel room.

CLAIM 5. The inventory-control system for allocating items of inventory in an optimal manner according to Claim 4, wherein each of said means for generating computer signals of said representative data comprises means for generating the respective said matrix array of n rows by m columns with each said row defining a specific, unique rate-category, and each said column defining a specific, unique type of room.

CLAIM 6. The inventory-control system for allocating items of inventory in an optimal manner according to Claim 2, wherein said inventory items comprise hotel rooms; each said first characteristic being a rate-category for hotel room, and each said second characteristic being a type of hotel room.

CLAIM 7. The inventory-control system for allocating items of inventory in an optimal manner according to Claim 6, wherein each of said means for generating computer signals of representative data comprises means for generating the respective said matrix array of n rows by m columns with each said row defining a specific, unique rate-category, and each said column defining a specific, unique type of room.

CLAM 8. The inventory-control system for allocating items of inventory in an optimal manner according to Claim 3, wherein said inventory items comprise hotel rooms; each said first characteristic being a rate-category for hotel room, and each said second characteristic being a type of hotel room.

CLAIM 9. A computer method of allocating items of inventory in an optimal manner, comprising:

(a) storing in computer memory data representative of said inventory items by first and second characteristics of each said inventory item, said data being representative of the total maximum

inventory of inventory items available for potential use;

(b) said step (a) comprising storing the data of said inventory items as a plurality of different groups of inventory items, each said group having at least one inventory item therein, each said inventory item in each said group being uniquely characterized from an inventory item in another said group, each said inventory item having a said first characteristic and a said second characteristic, with one of said first and second characteristics thereof being equal to a characteristic of at least one other inventory item of at least one other said group;

(c) said step (b) comprising generating computer signals of said representative data of said step (a) as a first matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the maximum potentially available said inventory items for the specific said group;

(d) storing in computer memory data representative of said inventory items by said first and second characteristics of each said inventory item, said data being representative of protected inventory items in said groups;

(e) said step (d) comprising storing the data of said inventory items as a plurality of different groups of inventory items, each said group having at least one inventory item therein, each

said inventory item in each said group being uniquely characterized from an inventory item in another said group, each said inventory item having a first characteristic and a second characteristic, with one of said first and second characteristics thereof being equal to a characteristic of at least one other inventory item of at least one other said;

(f) said step (e) comprising generating computer signals of said representative data of said step (d) as a first matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the blocked available inventory for the specific said group.

CLAIM 10. The method according to Claim 9, further comprising:

(g) storing in computer memory data representative of said inventory items by said first and second characteristics of each said inventory item, said data being representative of the total inventory items currently available for use;

(h) said step (g) comprising storing the data of said inventory items as a plurality of different groups of inventory items, each said group having at least one inventory item therein, each said inventory item in each said group being uniquely characterized from an inventory item in another said group, each said inventory item having a said first characteristic and a said second

characteristic, with one of said first and second characteristics thereof being equal to a characteristic of at least one other inventory item of at least one other said group;

(i) said step (h) comprising generating computer signals of said representative data of said step (g) as a first matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the number of inventory items currently available for use for the specific said group;

(j) storing in computer memory data representative of said inventory items by first and second characteristics of each said inventory item, said data being representative of the number of inventory items already used;

(k) said step (j) comprising storing the data of said inventory items as a plurality of different groups of inventory items, each said group having at least one inventory item therein, each said inventory item in each said group being uniquely characterized from an inventory item in another said group, each said inventory item having a said first characteristic and a said second characteristic, with one of said first and second characteristics thereof being equal to a characteristic of at least one other inventory item of at least one other said group;

(l) said step (k) comprising generating computer signals of said representative data of said

step (j) as a first matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween representing the number of inventory items already used;

(m) storing in computer memory data representative of said inventory items by said first and second characteristics of each said inventory item, said data being representative of the blocked inventory items still available for potential use;

(n) said step (m) comprising storing the data of said inventory items as a plurality of different groups of inventory items, each said group having at least one inventory item therein, each said inventory item in each said group being uniquely characterized from an inventory item in another said group, each said inventory item having a said first characteristic and a said second characteristic, with one of said first and second characteristics thereof being equal to a characteristic of at least one other inventory item of at least one other said group;

(o) said step (n) comprising generating computer signals of said representative data of said step (m) as a first matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column defining a specific, unique said second characteristic, the confluence therebetween being representative of the blocked inventory items

still available for potential use.

CLAIM 11. The method according to Claim 10, further comprising:

(p) storing in computer memory data representative of said inventory items by said first and second characteristics of each said inventory item, said data being representative of the desired total maximum items of inventory desired to be used for each said first characteristic, total maximum inventory items desired to be used by each said second characteristic, and total maximum inventory items desired to be used for all of said first and second characteristics combined;

(q) said step (p) comprising storing the data of said inventory items as a plurality of different groups of inventory items, each said group having at least one inventory item therein, each said inventory item in each said group being uniquely characterized from an inventory item in another said group, each said inventory item having a said first characteristic and a said second characteristic, with one of said first and second characteristics thereof being equal to a characteristic of at least one other inventory item of at least one other said group;

(r) said step (q) comprising generating computer signals of said representative data of said step (p) as a first matrix array of n rows by m columns, each said row defining a specific, unique said first characteristic and each said column

defining a specific, unique said second characteristic, the confluence therebetween representing the desired total maximum items of inventory desired to be used for each said first characteristic, total maximum inventory items desired to be used by each said second characteristic, and total maximum inventory items desired to be used for all of said first and second characteristics combined.

CLAIM 12. The method according to Claim 9, wherein each said step (a) and (d) comprises storing hotel rooms as the inventory items; each said first characteristic being a rate-category for hotel room, and each said second characteristic being a type of hotel room.

CLAIM 13. The method according to Claim 10, wherein each said step (a), (d), (g) and (j) comprises storing hotel rooms as the inventory items; each said first characteristic being a rate-category for hotel room, and each said second characteristic being a type of hotel room.

CLAIM 14. The method according to Claim 11, wherein each said step (a), (d), (g), (j), (m) and (p) comprises storing hotel rooms as the inventory items; each said first characteristic being a rate-category for hotel room, and each said second characteristic being a type of hotel room.

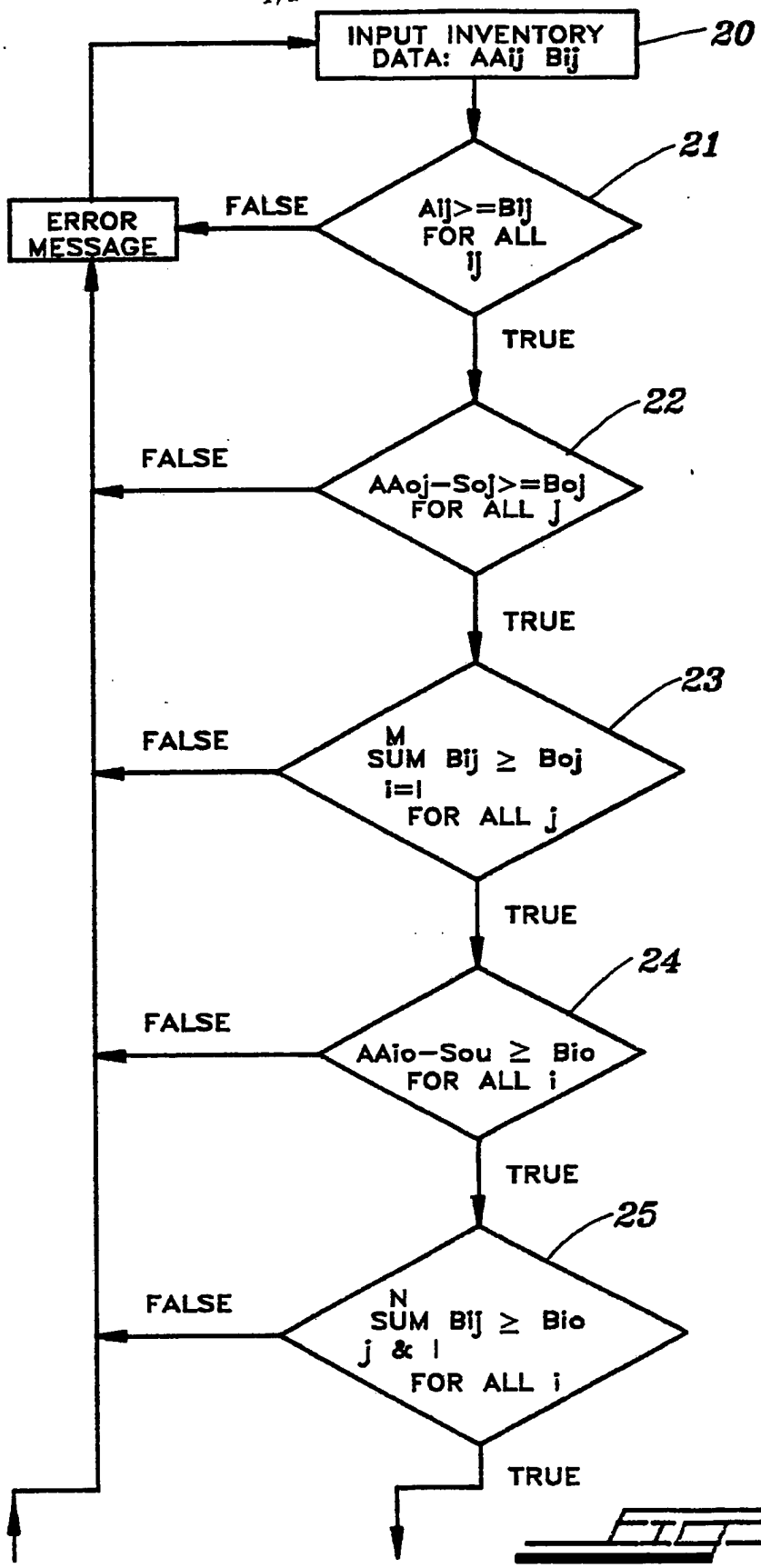
INPUT INVENTORY DATA: AAij Bij
20
Aij>=Bij FOR ALL ij
21
FALSE
ERROR MESSAGE
TRUE
AAoj−Soj>=Boj FOR ALL j
22
FALSE
TRUE
M SUM Bij ≥ Boj i=1 FOR ALL j
23
FALSE
TRUE
AAio−Sou ≥ Bio FOR ALL i
24
FALSE
TRUE
N SUM Bij ≥ Bio j & i FOR ALL i
25
FALSE
TRUE

FIG 1A

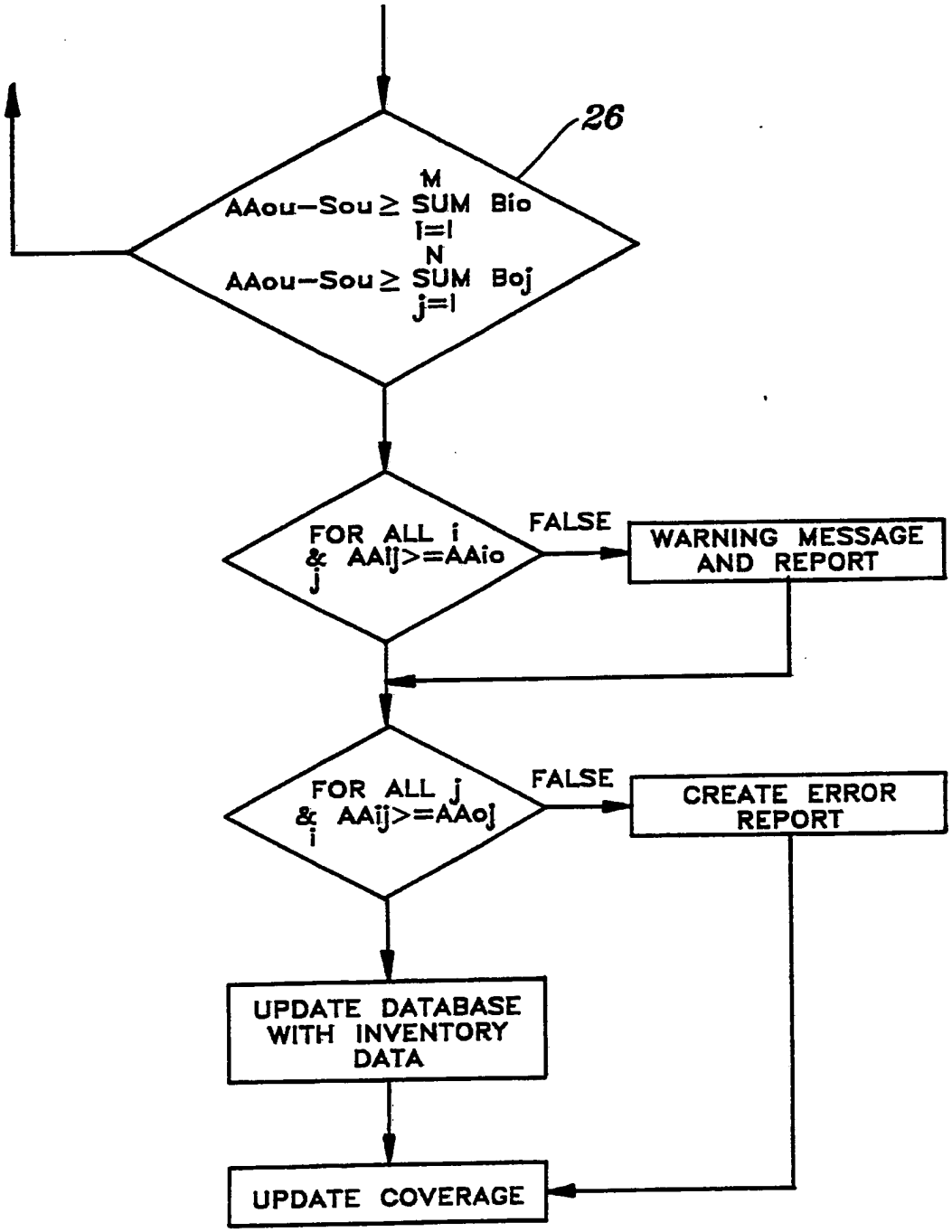
26
AAou−Sou ≥ SUM Bio (i=1 to M)
AAou−Sou ≥ SUM Boj (j=1 to N)
FOR ALL i & AAij>=AAio (j)
FALSE
WARNING MESSAGE AND REPORT
FOR ALL j & AAij>=AAoj (i)
FALSE
CREATE ERROR REPORT
UPDATE DATABASE WITH INVENTORY DATA
UPDATE COVERAGE

FIG 1B

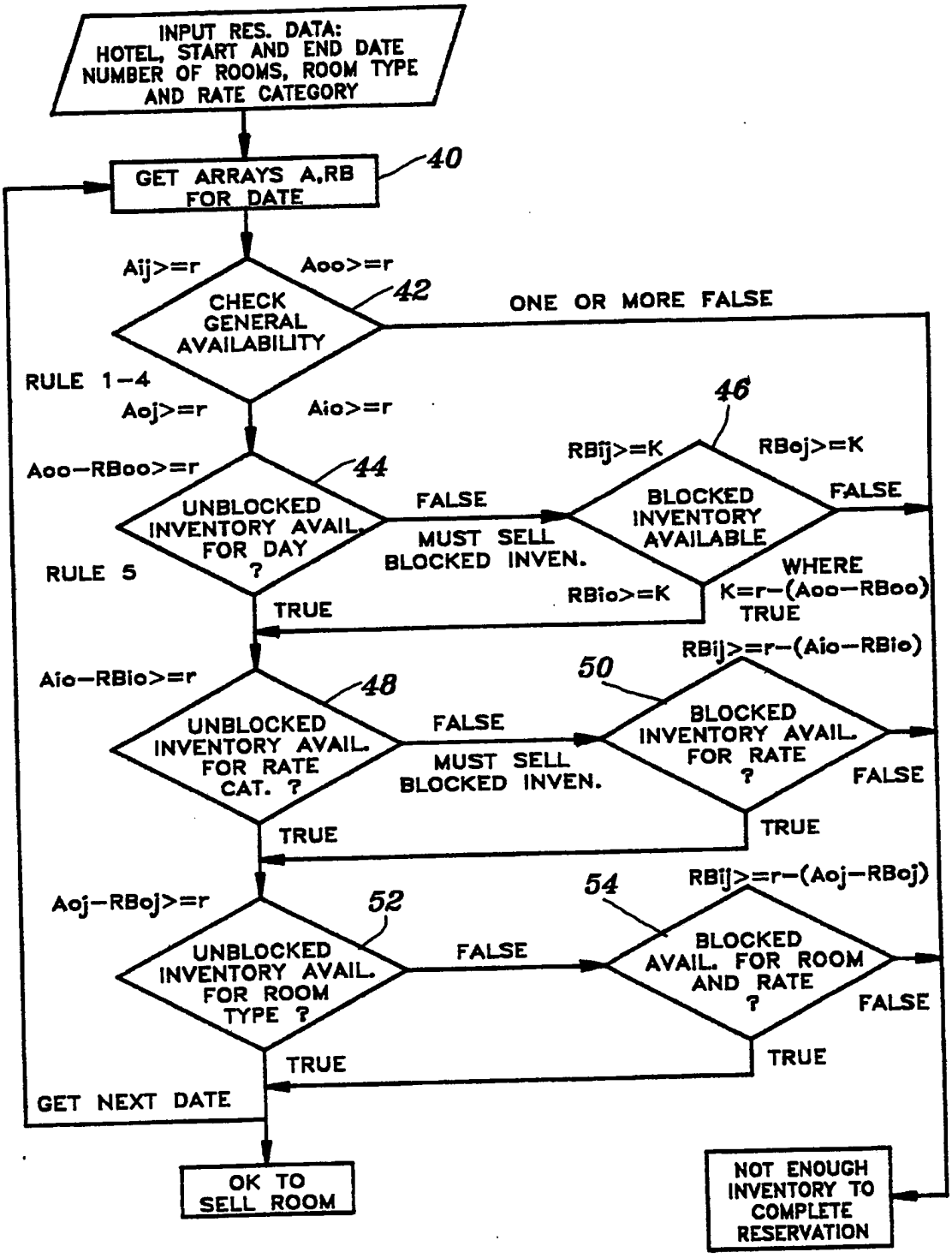
INPUT RES. DATA:
HOTEL, START AND END DATE
NUMBER OF ROOMS, ROOM TYPE
AND RATE CATEGORY
GET ARRAYS A,RB FOR DATE
40
Aij>=r
Aoo>=r
CHECK GENERAL AVAILABILITY
42
ONE OR MORE FALSE
RULE 1-4
Aoj>=r
Aio>=r
46
RBij>=K
RBoj>=K
Aoo-RBoo>=r
44
UNBLOCKED INVENTORY AVAIL. FOR DAY ?
FALSE
MUST SELL BLOCKED INVEN.
BLOCKED INVENTORY AVAILABLE
FALSE
RULE 5
RBio>=K
WHERE K=r-(Aoo-RBoo)
TRUE
TRUE
RBij>=r-(Aio-RBio)
Aio-RBio>=r
48
50
UNBLOCKED INVENTORY AVAIL. FOR RATE CAT. ?
FALSE
MUST SELL BLOCKED INVEN.
BLOCKED INVENTORY AVAIL. FOR RATE ?
FALSE
TRUE
TRUE
RBij>=r-(Aoj-RBoj)
Aoj-RBoj>=r
52
54
UNBLOCKED INVENTORY AVAIL. FOR ROOM TYPE ?
FALSE
BLOCKED AVAIL. FOR ROOM AND RATE ?
FALSE
TRUE
TRUE
GET NEXT DATE
OK TO SELL ROOM
NOT ENOUGH INVENTORY TO COMPLETE RESERVATION

FIG 2

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/05654

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): G06F 15/20; G06G 7/52

U.S. Cl. 364/407

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	364/407, 918.4 ; 235/385; 340/286.08

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	Data Sources, Volume 2, issued 1990 (Garden City, NY, USA, Computer Associates) See pages J-386 - J-390.	1-14
Y	US, A, 3,656,113 (LINCE) 11 April 1972 See the entire document.	1-14
A	US,A, 4,788,643 (TRIPPE ET AL) 29 NOVEMBER 1988 (See the entire document)	1-14

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
13 FEBRUARY 1992	26 MAR 1992
International Searching Authority	**Signature of Authorized Officer**
ISA/US	LAURA BRUTMAN

Form PCT/ISA/210 (second sheet) (Rev.11-87)